

## PROCESS & EQUIPMENT DESIGN CONSIDERATIONS FOR SCR

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### SUMMARY

Many retrofit SCR units are being designed and installed on large coal-fired utility boilers (over 500 MW) as retrofit applications, while there is little domestic operating experience on equivalent applications. The majority of the domestic coal-fired SCR operating experience is with medium-size, new units (~300 MW by IPPs), where the SCR inlet NO<sub>x</sub> is low (<0.4 lb/Mbtu) compared to retrofit applications, and the fuel is usually a low-to-medium sulfur coal. The retrofit of SCR on existing older boilers firing a high sulfur coal presents design, construction and operating problems typically not seen with the SCRs installed as original equipment.

There are four major areas of concern for retrofit SCR applications, which impact the SCR design and cost:

- Reactor Configuration – including associated ductwork
- Plant Modifications – to accommodate retrofit SCR
- Air Heater Fouling – due to ammonia and SO<sub>3</sub>
- Fly Ash Byproduct Utilization – due to ammonia contamination

The conventional configuration of the SCR reactor is with downflow flue gas, usually after upflow ductwork for the ammonia injection grid and mixing. This results in a vertical reactor at a high elevation. Most SCR reactor and ductwork layouts use conventional gas velocities in the ductwork (>2400 fpm) to maintain the fly ash in suspension in the flue gas. The high capital cost of an elevated, vertical SCR reactor and plant modifications to accommodate this SCR reactor presents an opportunity for new approaches to SCR configurations for high-sulfur coal retrofit applications.

In combination with OFA and SNCR, a hybrid SCR should have a significantly lower capital cost than a conventional SCR with a high retrofit difficulty on large, high-sulfur coal plants. The lower NO<sub>x</sub> to SCR after OFA and SNCR will reduce the catalyst required for SCR and reduce the NO<sub>x</sub> removal from the SCR. The smaller SCR reactor could allow the use of a short, horizontal gas flow reactor. This “short” reactor would also reduce the ductwork and associated structural steel and foundations for retrofit SCR and may reduce the plant modifications to accommodate the SCR. The relocation of the air heater may also allow the use of a short, horizontal “in-duct” reactor. The delay of air heater modifications (to an ABS tolerant design) will also slightly lower the cost of a retrofit SCR.

The design and installation of retrofit SCR on large coal-fired utility boilers will require detailed technical evaluation to determine the economic impact of the alternative SCR retrofit configurations on the capital and operating costs. These process and equipment design considerations will be reviewed and used to recommend the development of a hybrid SCR configuration.